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ANIMAL KINGDOM

THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the New York Zoological Society

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What Hope for African Animals?

THE SURVIVAL of the wild animals of Africa over the long future is without doubt a critical question. However, the current acute pessimism concerning their ultimate fate is often too extreme and does not take account of some realities. For instance, allowance is not made for the immensity of that continent, whose land area is more than three times greater than that of the United States including Alaska. Within it are remote regions which will continue for many years to be natural sanctuaries where the intrusion of man, the lethal predator, will not be too dangerously felt. But, this hopeful observation is not entirely valid because the extremely rapid increase of populations throughout Africa, if long continued, would ultimately preempt such natural refuges.

The real solution will depend upon the degree that the African people, now that they are attaining self-government, will become committed to wildlife protection. Fortunately, there are a number of hopeful signs that this will happen. For example, the Republic of the Sudan, a government independent since 1955, several months ago commissioned Frank Fraser Darling, Vice-president of our affiliate, The Conservation Foundation, to review existing conservation practices and game ordinances and to prepare a report on wildlife policy. Dr. Darling was assisted on the survey trip by George Merck, Secretary of our Society. A number of other developments of this kind come to mind, such as the expressed policies of the new Tanganyika government, including its specific action in regard to the permanent protection of the Serengeti National Park. The forthcoming meeting of representatives of a dozen or more African governments with conservationists and biologists in Arusha, Tanganyika, this September, will unquestionably give added impetus to the whole cause of wildlife protection throughout the continent. True, there are offsetting critical situations, such as the present acute threat to the National Parks of the Congo, a direct result of the chaotic conditions of the government and economy of that country. Nevertheless, close observers are of the opinion that a definite improvement in official attitudes in several other countries has occurred in the last year or two, the necessary preliminary to more effective protective action.

The New York Zoological Society has been working hard during the last few years to help in every way possible. This magazine contains a special report concerning what we have done. Our institution has a special responsibility which it must continue to meet.

Fairfield Osborn

Vanishing Giants & Enduring Dwarfs

THE TORTOISES

By HERNDON G. DOWLING

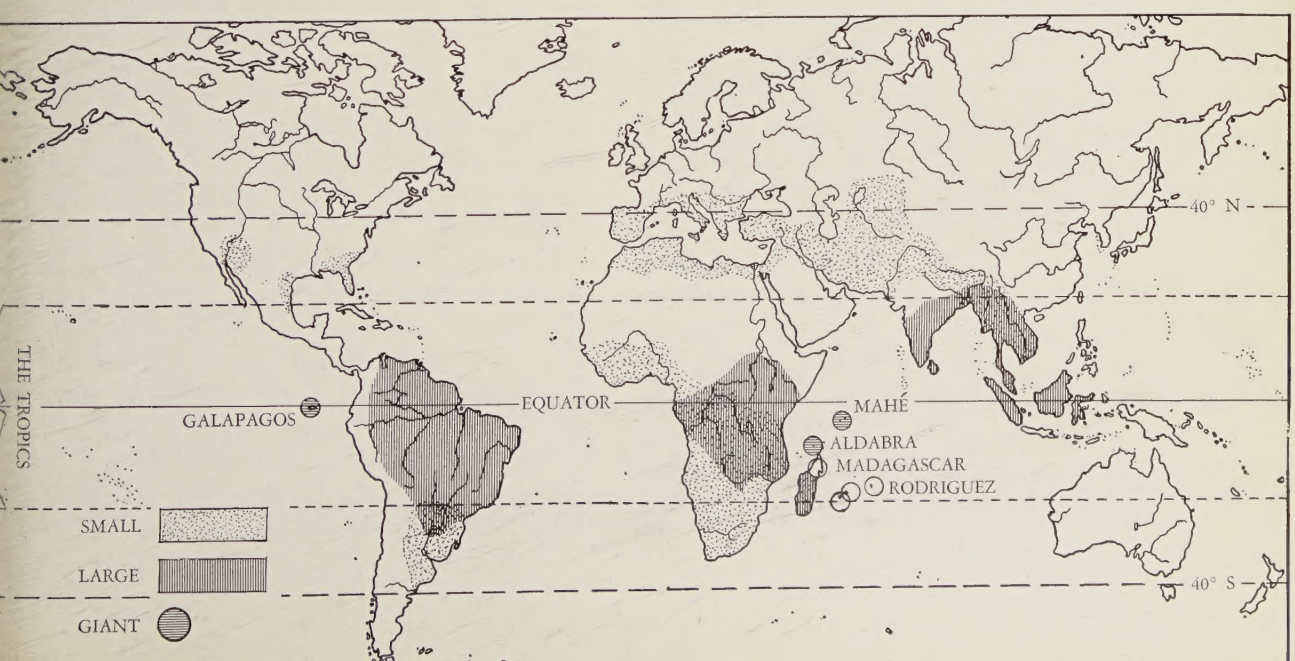
Curator of Reptiles

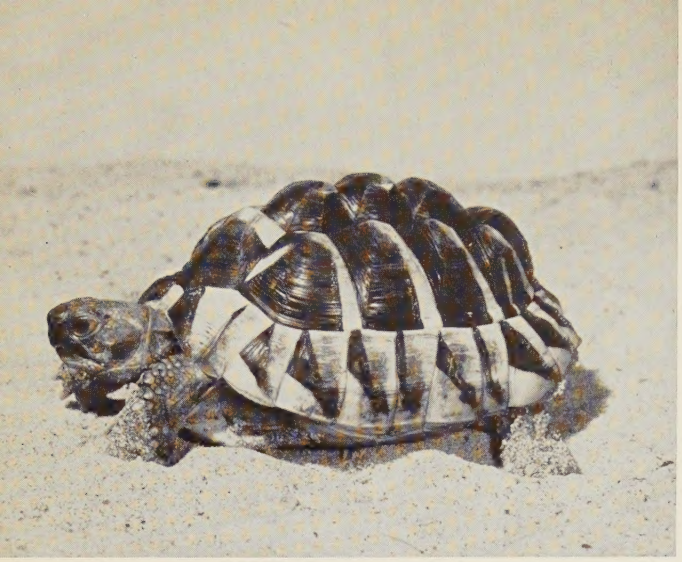
THOSE GROTESQUELY SHAPED, heavy-shielded, and elephantine-limbed terrestrial reptiles called land turtles or tortoises are well known to all of us. Of this group only the Gophers are native to the United States but, nevertheless, the tortoise tribe has been well publicized because of public interest in the giant tortoises of the Galapagos and Aldabra Islands. The last of these giant species are now on the verge of extinction and they may disappear from their native haunts in the present decade. The smaller species, however, appear to be still numerous and many of them, with the advent of cheap air transportation, are being brought to the United States for sale in pet stores.

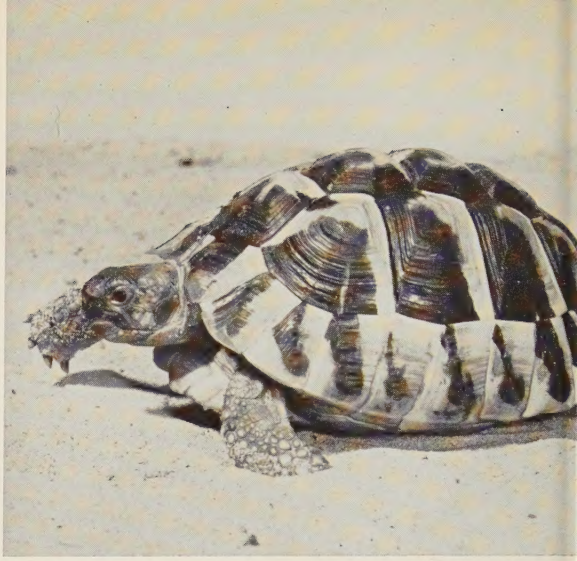
During the past few months, by gift and by purchase, we added to our collection of tortoises until at year's end we found that we had a greater variety than we had ever before exhibited in the Zoological Park. In this same period, while studying the tortoises that came in, I discovered to my amazement that it was by no means an easy task to identify a member of this small and supposedly well-known group. This was particularly true if the tortoise happened to be a juvenile, or an individual without locality data.

More than that, there would seem to be a major controversy shaping up on the proper names of these animals. I say this after comparing the ideas presented in the most recent world check list of turtles (Mertens & Wermuth, 1955) with those in an even more recent definitive

ft — "Teddy" is the oldest inhabitant of the Zoo-gical Park, a South American Tortoise (Geochelone enticulata) who came to us in 1914 from Theodore oosevelt. Below—Ranges of small tortoises are dot-d; larger species (Geochelone) vertically shaded. he three shaded spots show island homelands of e three living giant tortoises, while the hollow ngs indicate the ranges of those giant tortoises at have been exterminated within historic times.







Left — Moorish Tortoise (Testudo graeca) from southern Spain, northern Africa, western Asia and the southeastern Balkans. Right — Hermann's Tortoise (Testudo hermanni) from the north-central Mediterranean region. Both species have recently appeared in local pet stores.

work on African turtles (Loveridge & Williams, 1957). The tortoise names in these two authoritative papers differ for almost every species and even the familial relations are the object of some dissension. Such a controversy always leaves the non-specialist (even a snake specialist is not necessarily a turtle specialist these days) in a state of confusion until the last word is said and the final paper written. Museum curators can ordinarily leave the names of their specimens "as is" until the dust settles but zoological park curators are under considerable pressure from the public to name the animals on exhibition — and we prefer to use the *correct* names. So in such cases as this we have to read over the pertinent literature (and often a good deal that is not particularly pertinent), try to bring the various points of view into some sort of agreement, and then decide (sometimes with aid from the flip of a coin) on what names to use. It is true that in the present case the tortoise names may be settled by another paper by Mertens & Wermuth that is now pending. On the other hand it may be a generation before some final settlement is made. Thus the names used here are an interpretation of present ideas and may be changed tomorrow; such are the hazards of biological science. We expect, however, to be able to distinguish the tortoises no matter what their names are.

These land turtles, or tortoises, make up a group known to (some) zoologists as the subfamily Testudininae of the family Testudinidae. It contains 35 or 40 species (depending on the classifier), thus making it a fairly large segment (about one-fifth) of the turtles now living on this planet. This subfamily has two major components: the large tortoises, in which the adults are from one to three or more feet in length, belong to the genus *Geochelone;* the other component with approximately the same number of species contains the smaller tortoises with adult sizes of one foot or less. It, however, is broken up into no less than nine genera, seven of which are restricted to Africa or Madagascar.

Vegetarians all, the larger species have been subject to man's interest mainly as food. Several former species have become extinct within historic time for this reason and the few remaining giants are on the verge of following them into extinction. Many of the smaller species are brightly colored and all of them are more active and alert than most of the pond turtle group. Thus, they have been much in demand as pets in Europe, and are becoming a standard item of the pet trade in this country.

Thinking of land turtles, most of us would be tempted to place our old friend the Box Turtle (*Terrapene*) with this group. Such an idea would be violently opposed by a turtle taxonomist (a zoologist interested in the relations of these animals), however. He would point out that the smooth skin of the head (rather than scaly plates) and the webs between the toes (even though slight) are enough to show that the Box

Turtle is just a pond turtle gone wrong — a terrestrial member of the pond turtle subfamily Emydinae, not a true tortoise.

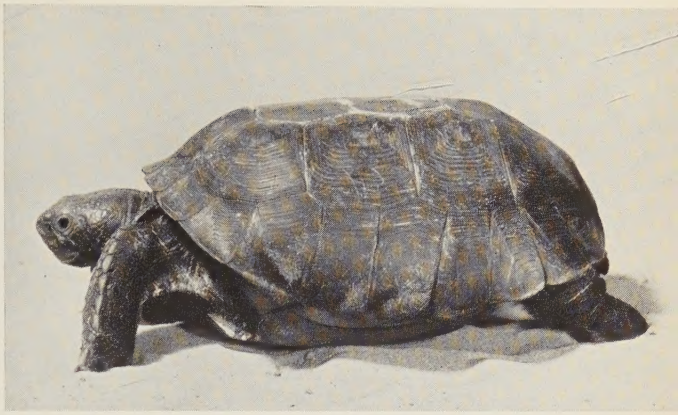
In times past any part-time biologist could point to a big tortoise and say, "Why, there is a *Testudo!*" This entertaining if not particularly informative ploy is no longer possible. The sprawling old genus *Testudo* that we once so readily applied to Galapagos tortoises and the like has been fragmented and the generic name *Testudo* now applies to only five species of smallish tortoises that live in the Mediterannean region. The most commonly seen of these are the Moorish and Hermann's Tortoises. These species have been kept as pets by Europeans for generations and recently they have appeared at local pet stores in considerable numbers. A pair of Moorish Tortoises kept by a Mr. C. F. Moysey in England have lived for more than 50 years and at last report (1956) were still in good health.

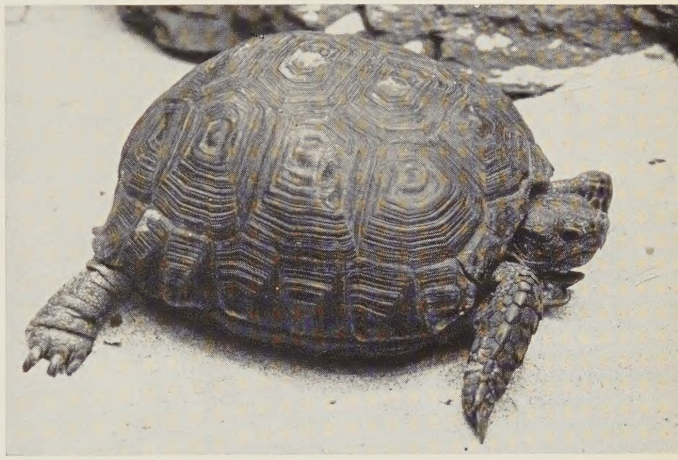
Perhaps the closest relatives of the Mediterranean tortoises are the Gopher Tortoises of the southern United States and northern Mexico. There are three separate populations that differ from one another mainly in shell and skull proportions, some being narrower, some broader. I am tempted to follow Mertens & Wermuth's check list on these and call them geographic races of a single species, although many workers consider them as distinct species. These tortoises do not appear to be nearly so hardy in captivity as are the Old World forms.

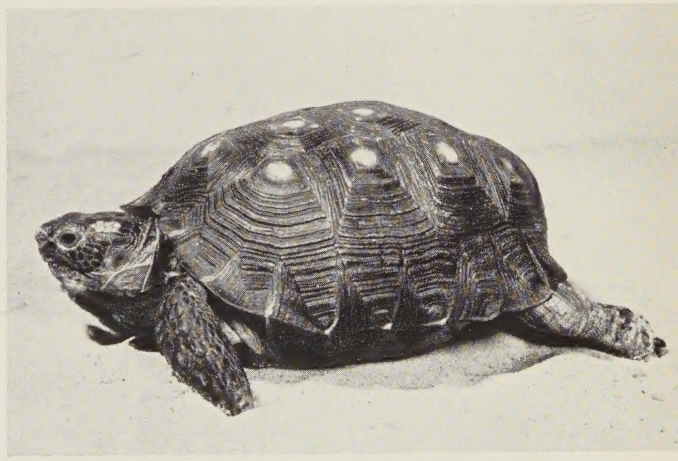
All of the other small tortoises are inhabitants of Africa and Madagascar. Some seven genera are now recognized among these, each genus containing only one to three species. Since they are relatively small animals, the Zoological Park has not made any considerable effort to obtain them. One of the more interesting kinds, however, the Hinged Tortoise, was exhibited long ago. It is unusual in that the carapace (upper shell) is hinged, rather than the plastron (lower shell) as in most turtles with hinged shells.

Another interesting species is the much flattened Pancake Tortoise, an inhabitant of arid rocky regions of East Africa. Having a flexible but horn-covered shell, it wedges itself into narrow crevices and then expands its body to resist being pulled out.

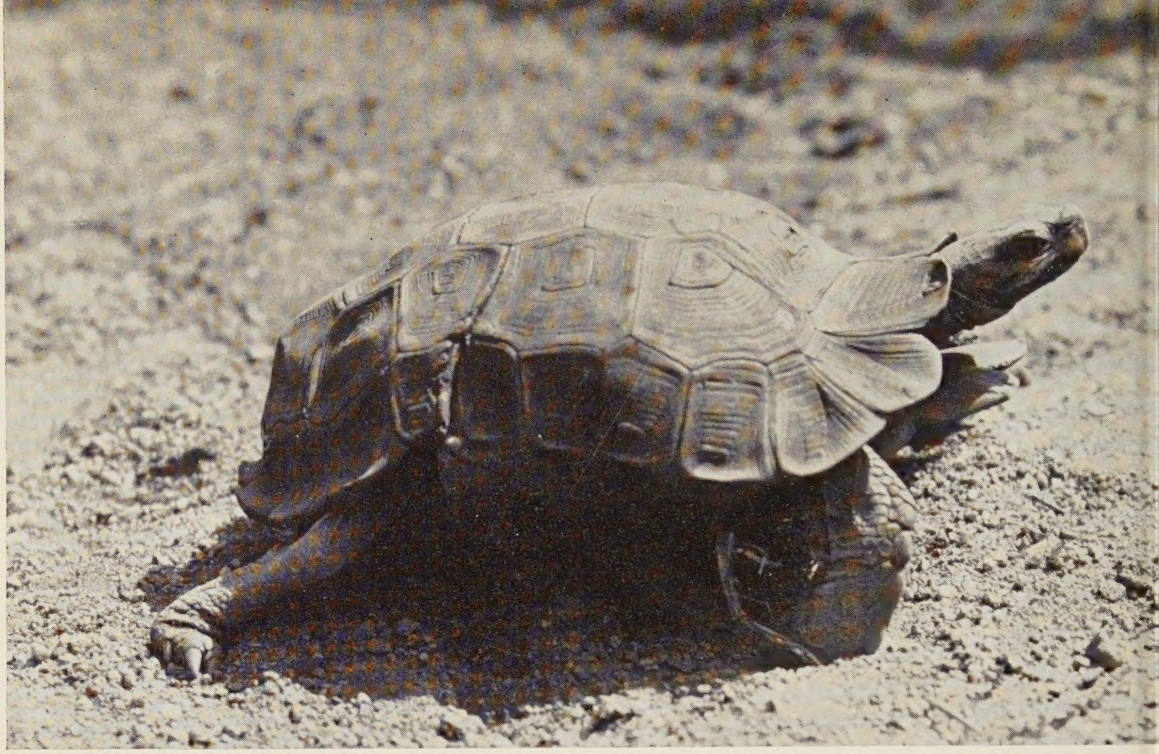
Representatives of two other small genera have

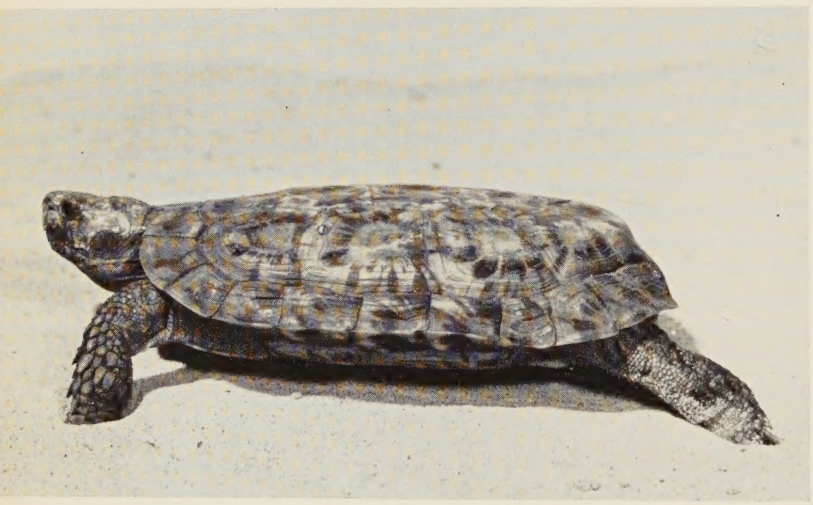






Gopher Tortoises (Gopherus polyphemus) of North America. Top — G. p. polyphemus is from the southeastern United States. Middle — G. p. berlandieri is found in southeastern Texas and northeastern Mexico. Bottom — G. p. agassizii is from southern California, Arizona, Sonora. All look much alike.





Top — From West Africa comes the Hinged Tortoise (Kinixys erosa), whose hinge can be seen across the posterior part of the shell. Left — The much-flattened Pancake Tortoise (Malacocersus tornieri) is an inhabitant of the arid and rocky regions of East Africa. It can wedge itself in a narrow crevice and then expand so as to resist being pulled out.

come to us recently by the purchase of a private collection of baby tortoises from Henry Gscheidle of New York. The Parrot-beaked Tortoise is of South African origin and little seems to be known of its habits in captivity. The Angulated Tortoise is also of South African origin and is somewhat better known. It appears to prosper under captive conditions and might, with its reddish plastron and alert disposition, become a favorite pet species.

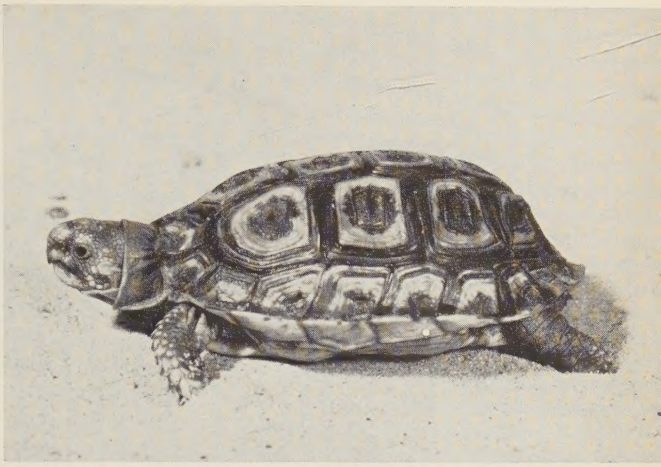
Most of the tortoises that have been exhibited in the Zoological Park have been of the larger species that are now placed in the genus *Geochelone*. Apparently, not only all of the giant tortoises of today but also the giants of past ages belonged to this group. The fossil record shows that in the past when the climate all over the world was little different from that of the deep tropics today, the giant tortoises were found throughout this continent as well as in northern Europe and Asia. The icy blasts of Pleistocene glaciers drove them toward the equator, however, and the cold winters of the temperate zones kept them from returning to their ancient stamping grounds. Meanwhile man, their greatest enemy, had become a common creature and has been the

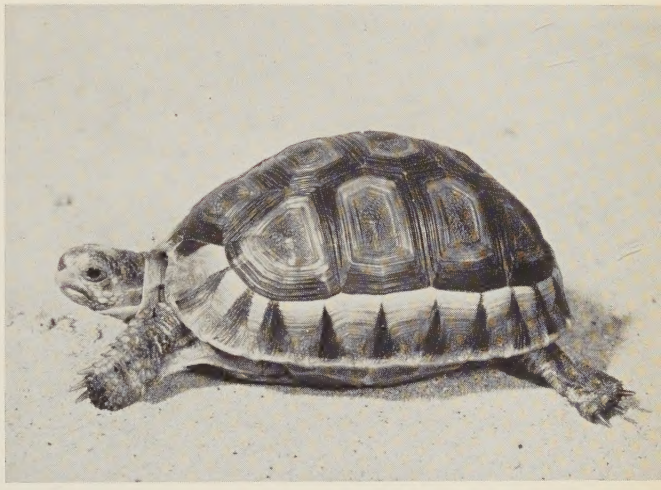
major cause of their disappearance from their Pleistocene retreats.

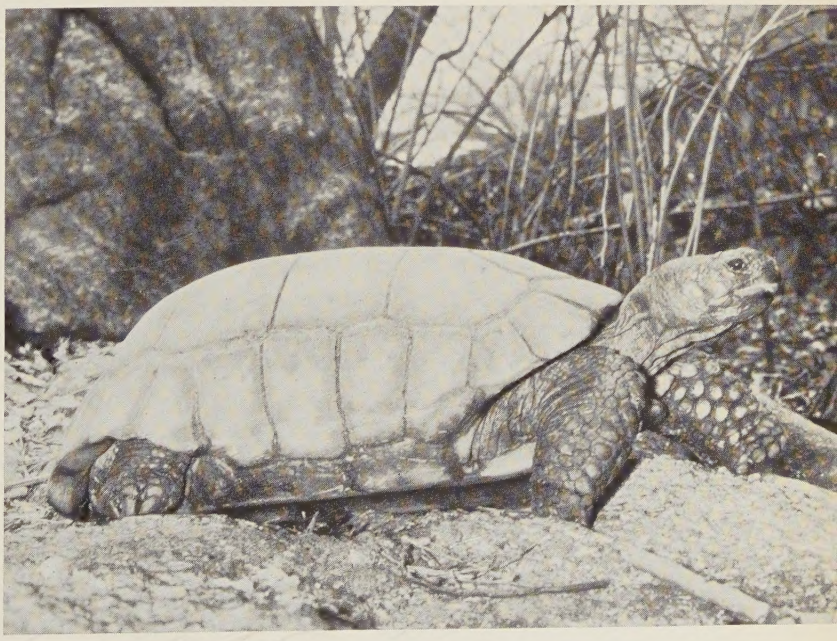
A comparison of the ranges of the smaller tortoises with those of their larger relatives shows clearly the differential effect of temperatures on these animals. The smaller tortoises, that can burrow and avoid the cold temperatures of winter, range broadly through the temperate zones (though, like most reptiles, mainly below the 40th parallel). The larger species, however, are too big to make extensive burrows and avoid freezing in this way. They are found almost exclusively within the tropics and the real giants are found within 10 degrees of the equator. Thus, though apparently scattered indiscriminately on small islands in different oceans, giant tortoises are really concentrated in a rather small region having the least variation in temperatures.

The oldest inhabitant of the Zoological Park is "Teddy," a South American Tortoise that was donated to us by Theodore Roosevelt on March 26, 1914. For many years it was thought that there was only one kind of "South American Tortoise" in northern South America, but last year Dr. Ernest Williams of Harvard pointed out that actually there are two. The other species is also in our collection. It is called the Red-footed Tortoise and does not attain nearly as great a size as the previously-recognized tortoise.

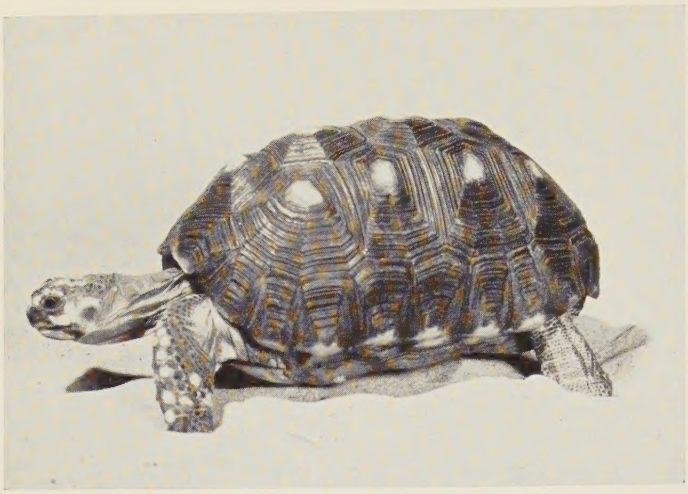
One of the most strikingly colored of the larger





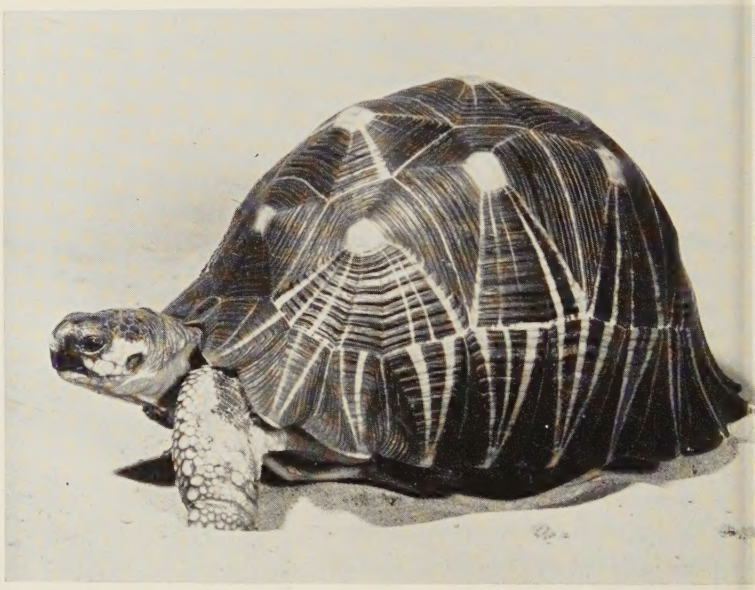


Top—The Parrot-beaked Tortoise (Homopus areolatus) comes from South Africa and little is known about its habits in captivity. Middle—The Angulated Tortoise (Chersina angulata), also from South Africa, is a vigorous and highly colored species. Bottom—"Teddy," a South American Tortoise (Geochelone denticulata), is 22 inches long and weighs 46½ pounds. For many years it was believed that there was only one "South American Tortoise," but two kinds are now recognized. We have the other species also, pictured on p. 72.



Left — The "other" species of South American Tortoise is the Red-footed Tortoise (Geochelone carbonaria) from the northern part of the continent. It does not attain nearly the size of the species represented by our oldest Zoo inhabitant, "Teddy."

Right — Radiated Tortoise (Geochelone radiata) of Madagascar. This specimen, a female, weighs 22 pounds and has been in captivity for about thirty years.



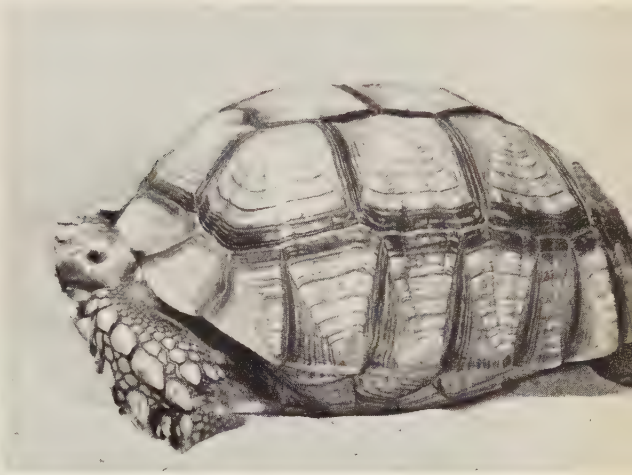
tortoises is the Radiated Tortoise. Last year we received one of these fine tortoises as a gift from Mrs. George Flowers of Brooklyn, who had kept it as a pet for more than 25 years. It is a female 14½ inches in length and now weighing 22 pounds — having grown somewhat too large for an apartment pet. We have since obtained two others to keep it company.

The Star Tortoise of India is similarly marked with black and yellow, but does not grow to the large size of the Radiated. It appears to live well in captivity and would seem to be an ideal choice as a pet.

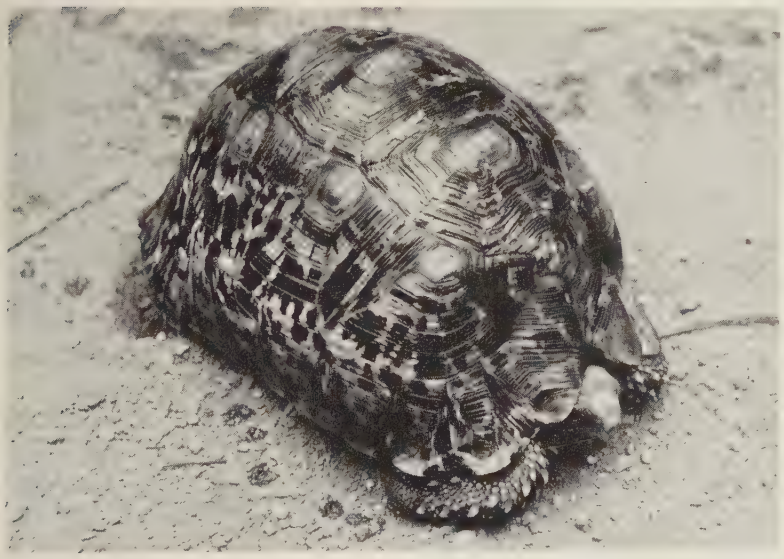
Two African species, the Leopard Tortoise and the Spurred Tortoise, have adjacent ranges and differ mainly in color, and ultimately will probably be recognized as members of the same species. We exhibited the Leopard Tortoise many years ago and recently obtained an example of the less colorful, but rarer, Spurred Tortoise.

The giant tortoises that were once such a conspicuous feature of the reptile exhibit are no longer in the Zoological Park. This is not because the species are extinct (they are not, quite), but because after the renovation of the Reptile House in 1954 our winter quarters were not adequate for keeping them in good health and we sent the really big individuals "on loan" to Crandon Park Zoo in Miami. Four of the smaller tortoises were kept as examples of two of the

Left — Star Tortoise (Geochelone elegans) of India and Ceylon; this is a beautiful species that lives well in captivity and seems to be ideally suited to be kept as a pet. The maximum size it attains is about one foot.



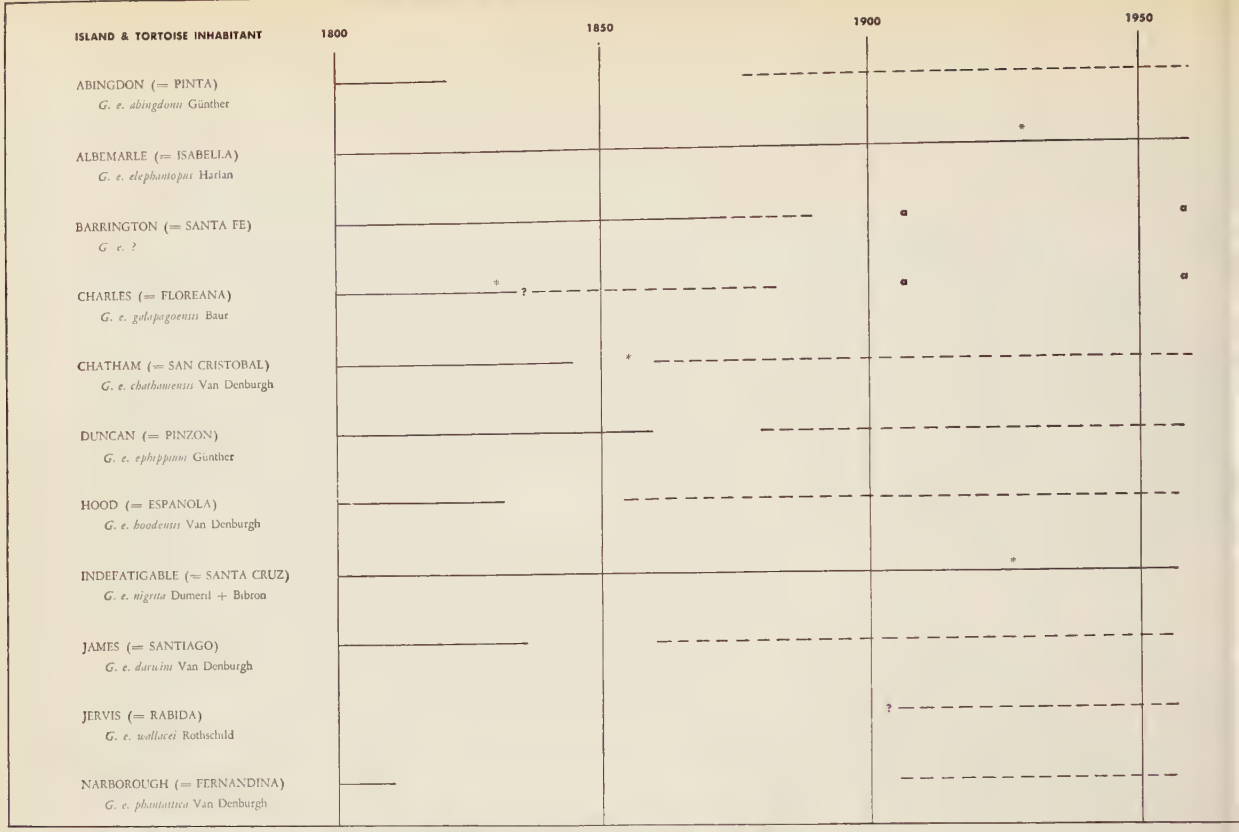
Right — Northeastern Africa is the home of the Spurred Tortoise (Geochelone sulcata), a unicolor form not so often seen in captivity as its relative, the Leopard Tortoise.



Left — Leopard Tortoise (Geochelone pardalis) of central Africa. It attains a length of two feet and may weigh 50 pounds or more. In time it will probably be recognized as of the same species as the Spurred Tortoise, occupying an adjacent range.

Galapagos forms. We have exhibited the Aldabra Tortoise, *Geochelone gigantea* (Schweigger), in the past, but have not attempted to do so in recent years because of the limited space available.

In the past as many as fifteen "species" of giant tortoises were recognized on the various islands of the Galapagos, with at least one kind on each of the main islands. More recently they have been called geographic races of a single species, although they differ widely in proportions and shell-shape. First discovered in 1535 and throughout the 18th and 19th centuries collected as food for the crews of whaling ships,



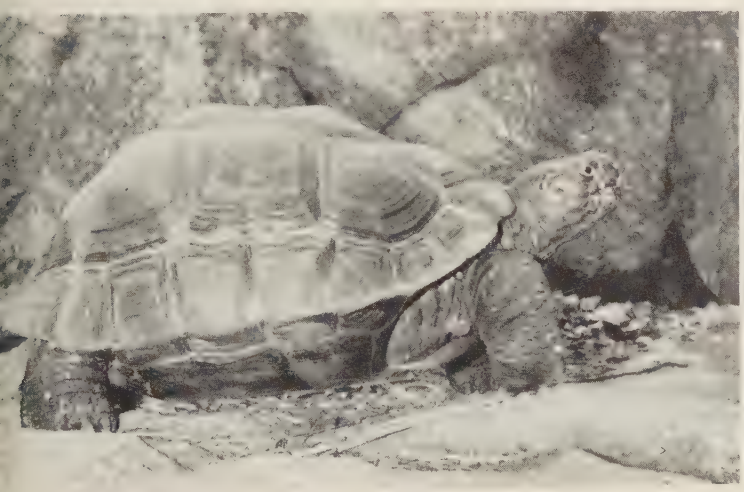
Top — A condensed history of the Galapagos Tortoises. (Solid line = numerous; dashed line = rare; a = reported absent or extinct; * = permanent residents (man) reported). Two questioned items are continued presence of tortoises on Charles Island after 1837, and the origin of tortoises on Jervis Island, thought by some to have been introduced there from Albemarle I. in 1891. Left — This Galapagos Tortoise (Geochelone e. elephantopus) is a specimen that came to us many years ago from Albemarle Island.

they are still eaten by the island inhabitants and rendered for oil by occasional parties from the mainland, although in theory they are protected from such depredations. As shown in the accompanying diagram, the tortoises of two of the islands are now extinct, are rare on most of the remaining islands, and were reported (in 1957) as common only on two.

Their future is far from secure even on Albemarle and Indefatigable. These islands have been colonized in the present century and the turtles must not only compete for food with feral asses, cattle and goats, but the young must also run the gauntlet of feral mice, rats, cats, dogs and pigs. It is said that probably "not one in ten thousand" young grows to adulthood.

The only hope of saving any of the Galapagos tortoises on their native islands (and the other native life as well) would appear to rest in the small laboratory built last year under the sponsorship of the Charles Darwin Foundation. The New York Zoological Society as well as UNESCO and other institutions have aided this project in a small way, but it undoubtedly will require much greater support to be effective. In a recent letter to William Conway, Mr. R. Leveque, the field naturalist of the laboratory, reported that the tortoises were so rare on Indefatigable that he had not seen a single wild individual in his entire six-months' stay to that date. And this on one of the two islands where they were reported as "numerous" in 1957!

Two of our present specimens are from Chatham Island and the other two from Duncan Island. The Duncan Island individuals are from the Townsend Expedition that was sponsored by the Zoological Society in 1928. Many of the giant tortoises on exhibit in other zoological parks were obtained from this same source. The purpose of the expedition was to obtain a breeding stock so that they might not disappear from the face of the earth, should they become extinct in their native islands. More than a hundred small tortoises were collected. They have grown to adulthood now, but only the San Diego Zoological Park has had any success in getting them to breed. However, we are hopeful that we can obtain the winter quarters necessary for successfully maintaining them and that we, too, may carry on the work of conserving these unique animals — a work that was initiated by the Society in 1928.



Galapagos Tortoise* (Geochelone elephantopus chathamensis) *from Chatham Island. This one is from an expedition in 1957.

Saddleback Tortoise* (Geochelone elephantopus ephippium) *collected on Duncan Island by Charles H. Townsend in 1928. It is still living in the Bronx Zoo.

Fish Without Fathers

By JAMES W. ATZ

Associate Curator, New York Aquarium

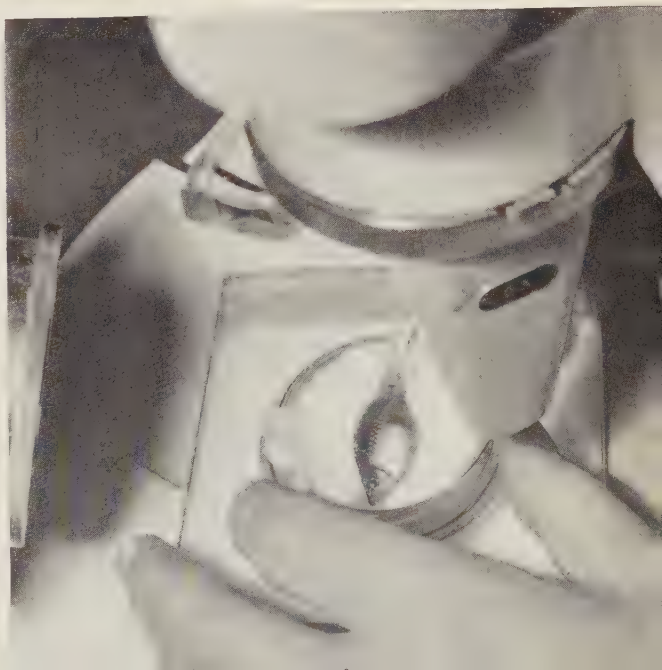
THERE ARE MORE than 4,000 fishes in the Genetics Laboratory of the New York Aquarium. They are small ones and although some of them have attractive or unusual color patterns, none could be considered at all spectacular. It is not their appearance, but their usefulness in scientific research that makes them noteworthy and important.

About a tenth of the Laboratory's fishes form a group perhaps even more nondescript in appearance than the rest. A local fisherman might take them for some kind of killie – to which they *are* distantly related. A tropical fish fancier would undoubtedly recognize them as one of the mollies, but certainly not of any variety that he would choose to grace his home aquarium. The fancier would certainly be struck by one peculiarity: all of them, both young and old, are females. As for males – there aren't any! For the astonishing truth is that here is a species of fish in which more than 99% of the individuals are females which regularly give birth to broods consisting only of females like themselves.

The Amazon Molly, as it has been appropriately named, was first described in 1859, but its peculiar reproductive behavior was not discovered until 1932 when Prof. Carl L. Hubbs and his wife, Laura, began to breed the fish at the Museum of Zoology of the University of Michigan. Dr. Hubbs had been studying the different kinds of mollies and he knew that although he had in his Museum collection hundreds of preserved specimens of *Mollienesia formosa* (from *formosus*, Latin for graceful or beautiful), which had been caught in many places in northeastern Mexico and southern Texas, every one of them was a female. Soon Dr. and Mrs. Hubbs reported that gravid females captured alive and brought into the laboratory gave birth to broods consisting entirely of daughters. At first this looked as if it might be a case of parthenogenesis, or virgin birth, but any *M. formosa* kept isolated from male fish never produced any young. When virgin *M. formosa* were mated with male mollies of other species, however, the offspring were all females that looked exactly like their mother! In nature, *M. formosa* lives side by side with other mollies, *M. sphenops* and *M. latipinna*. It was logical to conclude that the all-female species "used" the males of the others to propagate the race, the offspring never being hybrids but pure *formosa* just like their mothers.

For twelve years Dr. and Mrs. Hubbs carried on their breeding experiments with the Amazon Molly. In all, they bred about 8,000 of them, all female and all carbon-copies of the fish that bore them. The Michigan investigators found that the Amazon's mate did not have to be a mollie, but that when another type was used the number of offspring was decidedly less than when a species of molly acted as pseudo-father. At least ten different, but more-or-less closely related, species have been mated with Amazon Mollies and have produced not hybrids, but more Amazons. Evidently it is necessary that the Amazon Molly – or what is much more likely, its eggs – be stimulated by some physiologically compatible male before development can occur. The exact process is uncertain, but most probably the sperm "triggers" development of the egg but contributes nothing to the heredity of the new generation – and so "father" is really not the father. Biologists have found similar "fatherlessness" in a beetle and a few worms and have pro-

Top — A view of the Genetics Laboratory of the Aquarium, housed in the American Museum of Natural History. Dr. Klaus D. Kallman, Research Associate in Genetics, is here continuing the work of the late Dr. Myron Gordon, among the laboratory's 655 tanks. Right — Preparing a Platy for transplant.



duced it experimentally under laboratory conditions in some frogs, newts and invertebrates. (They call the phenomenon *gynogenesis* or *pseudogamy*). When Amazon Mollies were microscopically examined, in an effort to find out exactly what was happening to their eggs, no direct evidence could be found, but this might have been because the cells of fishes are notoriously difficult to study under the microscope – much

more so than those of frogs, insects and many other invertebrates.

At any rate, there were still many provocative, unanswered questions about how the Amazon Molly propagated itself and what was the exact genetic relationship between mother and daughter. In fact, the situation was so startlingly different from anything known to occur naturally in a backboned animal that some biologists expressed doubt about its very existence.

What was needed was some new way to analyze the problem, and Klaus D. Kallman of the Aquarium's Genetics Laboratory had developed a new technique exactly suited to this need. He had developed this new research tool for another purpose, but as is so often the case in science, it proved to be perfectly adapted for another, unanticipated task.

In 1953, Kallman was a new graduate student at New York University with a keen interest in the genetics and physiology of fishes. Naturally he sought advice from Dr. Myron Gordon, who was a member of the faculty as well as the Aquarium's Geneticist. It was arranged that Kallman would do his research work in our Genetics Laboratory. When the time came to select a thesis subject, Dr. Gordon made a suggestion that was to open up a whole new field of investigation in the laboratory. Why not, he asked, try to transplant fins between members of the inbred strain of Common Platyfish in the Laboratory?

Behind this deceptively simple suggestion lay a good deal of up-to-date biological theory, in addition to 15 years or more of painstaking, single-purposed effort of Dr. Gordon himself. Transplantation is not a new experimental procedure in biology; some of the pioneer experiments with endocrine glands and embryos involved the transplantation of organs or tissues from one animal to another. In medicine, too, skin grafting became an approved treatment for extensive burns, and bone grafts for use in orthopedic surgery. In all of these procedures, however, successful permanent transplants or grafts could be obtained only if they were made from one part of a single individual's body to another, or between identical twins, or members of the same closely inbred strain. (Embryos are often exceptions in that they do not react adversely to strange tissues). Otherwise, although the transplanted, foreign tissue or organ might at first look healthy, eventually it would break down, disintegrate completely and disappear. The basis for this incompatibility was eventually shown to be hereditary, and in some cases could be traced to the activity of definite genes. The ability of the body to produce specific substances that destroy the foreign tissue that has "invaded" it is related to its ability to overcome disease-producing microorganisms, but whereas doctors try to enhance the latter ability, there are times when they wish the body would not react to tissues belonging to other more-or-less unrelated individuals. If this defense mechanism could be circumvented, doctors foresee lifesaving "banks" of hearts, kidneys and other vital organs, just as blood banks are now a regular part of the medical scene.

Fish scarcely differ from man or mouse in this regard. Up to the time Kallman started his experiments, no one had ever succeeded in transplanting fins, or any other structure for that matter, from one fish to another. Dr. E. E. Held of the University of California showed that the dorsal fin of a Common Platyfish could be moved to its belly region, but that fins from another Platyfish survived for less than a month. Held's work had led Dr. Gordon to suggest that the strain of Platyfish he had been so carefully inbreeding for the past 15 years be used in a similar experiment. Dr. Gordon predicted that these fish, which had been systematically bred brother-to-sister for nearly 20 successive generations, would accept fins from each other as if they were their own, because he believed they were genetically as alike as identical twins. His prediction was abundantly fulfilled. As soon as Kallman had mastered the mechanical details, he was able to transplant fins with 100% success.

Since the summer of 1954 when he made his first successful fin transplants, Kallman has made thousands more of them. In the course of one series of experiments, he made almost 3,000 transplants involving about 4,000 fish. This work comprised his doctoral thesis and dealt with how genes function in affecting survival of transplanted tissues. In another series of experiments, Kallman determined that at least 12 genes were concerned in the reaction of the Platyfish host to a foreign fin.

Having developed an infallible transplantation

The laboratory maintains inbred Swordtails as well as Platyfish and this is a Swordtail which developed an extra sword after an early transplant of a tailfin.
Klaus D. Kallman Photo

technique, Dr. Kallman could now use it to determine the genetic relationships between fishes. In other words, if fin transplants between two fishes were successful, it would be safe to assume that they were genetically identical, or very, very nearly so. This is exactly what biologists wanted to know about the Amazon Molly and her offspring! Are they genetically alike? And if each daughter is really a genetic carbon-copy of her mother, she and all her sisters must be in effect the same as identical twins. Transplantation tests on Amazons donated by Dr. Caryl Haskins, and their offspring, showed that in any Amazon family all the members are indeed alike, since fin transplants among them "took" without exception, while those involving fish from different families did not. Each fatherless group could be considered a *clone*, which is the biologists' term for the animals or plants descended from a *single* parent.

The next step was to obtain wild Amazon Mollies for testing, which Kallman caught near Brownsville, Texas. Fin transplants showed these fish to be even more homogeneous than expected. All of them proved to be members of but three clones. The implications of this for evolutionary theory are too complicated to outline here; suffice it to say that they have given Kallman plenty of food for thought. One of his current projects is to obtain more samples of wild Amazons for testing. His transplantation test gives him the rare opportunity to describe the population structure of the species in nature, which should in turn provide definite clues as to how its unorthodox method of reproduction evolved.

Mention ought to be made of the fact that once in a great while, a male *Mollienesia formosa* turns up. If and when Dr. Kallman gets a chance to test one of these and its offspring – supposing that it does actually contribute to the heredity of the young – a better understanding of the significance of such masculine rarities will be forthcoming.

Last year Dr. Kallman's fin transplantation test enabled him and Dr. John Kilby of the University of Florida to prove that true parthenogenesis can occur in fish. Dr. Kilby was conducting extensive breeding experiments with Mosquito Fish (*Gambusia affinis*), and two females that he was sure were virgins had thrown a few young. In such cases, there is always the nagging possibility that somehow a male got in and out of the female's aquarium unseen. To clinch the matter, Kallman made a trip to Gainesville and transplanted fins from the young fish to their mother. They "took," thus demonstrating that no male had contributed to the heredity of the offspring to make it different from that of the mother. Dr. Kilby's case for parthenogenesis is air-tight now.

Fins are not the only structure that Dr. Kallman has been able to transplant from fish to fish. Skin, scales, pigment cells, heart, spleen, kidney, gonad and pituitary gland have all been removed from one fish and made to flourish in another. Thyroid tumors and pigmented cancers (melanomas) have been transplanted from sick to healthy fish. The possibilities for new experiments seem endless. For example, Dr. Kallman is inbreeding a strain of hybrid origin that regularly develops a melanoma on its dorsal fin, which is an ideally accessible location for observation and transplantation. With these and other special strains – some already in existence in the Laboratory, others to be made-to-order – Dr. Kallman is planning critical experiments on the origin, migration and development of normal and cancerous pigment cells. The Genetics Laboratory stands on the threshold of exciting and fruitful times.

Zoo News in Pictures

Photographs by SAM DUNTON

There is a lot of "Springtime in the Zoo" atmosphere in this scene on the **ROOSEVELT ELK** range in the center of the Zoological Park – a wild and undisturbed scene that we often find visitors gazing at for many minutes at a time. The Elk herd is still small; it includes three cows, a buck and a yearling cow. But in the normal course of things we can expect annual additions – one, at least, is likely this year – and we hope to build the herd up to sizeable proportions. (A fawn was born May 30).

The **INDIAN PANGOLIN**, *Manis crassicaudata,* had not been represented in our collection until an adult female and two young arrived this spring. Pangolins usually have one young, rarely two, and we are not certain whether the babies both belong to the female. Only one is still nursing, in any event. They appear to be doing well on our anteater diet.

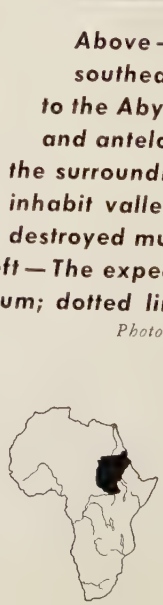
It is doubtful that anyone has ever before exhibited the **LAMINATED-BILLED TOUCAN** from Colombia and Ecuador; we received our first one a few weeks ago. The peculiar name comes from the plate at the base of the brightly colored bill. It is being exhibited in the Toucan hall of the main Bird House.

Dogs are not allowed in the Zoological Park – but **DINGOS** are. These are two Dingo pups, born on January 1 in a litter of seven. These two will be kept for breeding stock, and since they have been virtually hand-reared Keeper Foster allows them the run of the Kangaroo House before opening time every day.

New York Times: Brower Photo

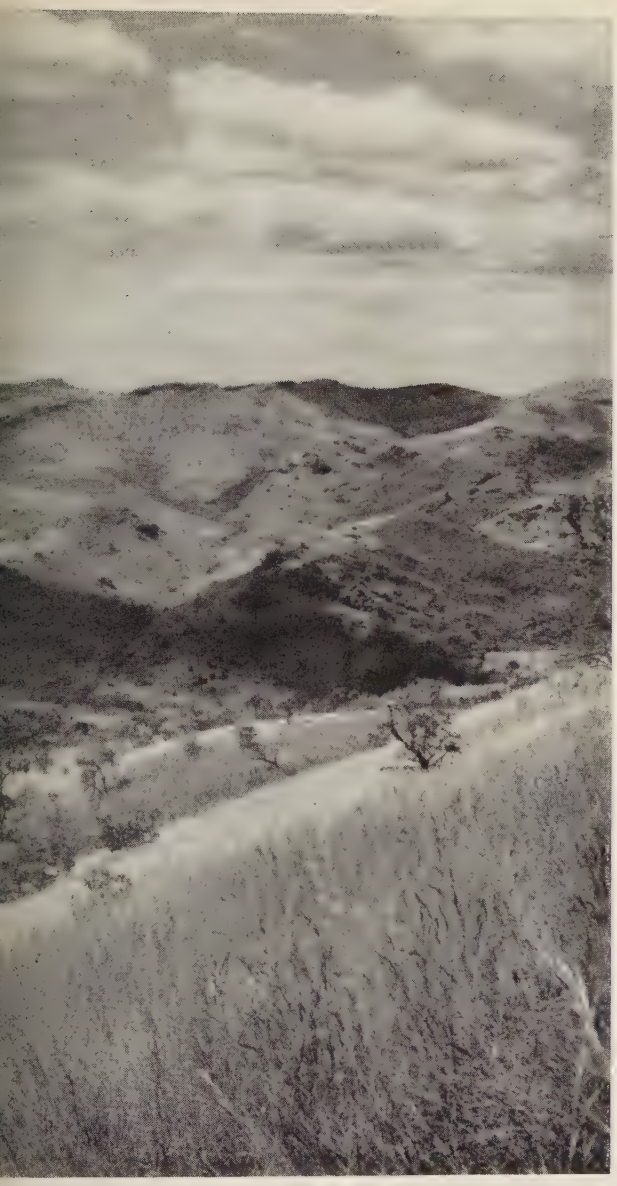
A Look at Wildlife in the Sudan

By GEORGE W. MERCK
Secretary of the Zoological Society



Above — The Boma Hills in the southeastern Sudan are close to the Abyssinian border. Zebras and antelopes and giraffes roam the surrounding plains and buffalo inhabit valleys and hills. Fire has destroyed much of the forest cover. Left — The expedition started at Khartoum; dotted line indicates its route.

Photos by the Author



FOR MORE THAN SIX WEEKS, beginning at the end of January, Dr. F. Fraser Darling, Vice-president for Research of the Conservation Foundation, and I travelled in the Republic of the Sudan. We were there as guests of the Sudanese Government, to assess the wildlife with regard to population and condition of habitat, and particularly to recommend measures for conserving this important national asset for the future. The available time, of course, was much too short to make a detailed and complete study such as Dr. Darling has made in two other important game areas of Africa – the Luangwa Valley in Northern Rhodesia and the Mara Plains of western Kenya. Nevertheless, we were able to see a considerable amount of country and some of the species of larger mammals, and to obtain what we hope are enough data to recommend an effective policy for the proper conservation of game.

The Sudan is an immense country. It stretches over 18 degrees of latitude south from the Egyptian border, a distance equal to that between Toronto and Palm Beach. From east to west, the country is a thousand miles across at the widest point, and it covers almost a million square miles. This is two-fifths the area of the United States.

Beginning at the north, the Sudan separates roughly into five principal divisions of vegetation: desert, acacia desert scrub, acacia short-grass scrub, acacia tall-grass forest and broad-leaved woodland and forest. Rainfall varies from complete drought in the desert north to sixty inches in the extreme south and, as might be expected, is responsible for the gradation of the vegetation. Immense flat expanses of bush, woodland or marsh, broken occasionally by rolling hills, compose the principal scenery. In the south, mountain groups rise to 10,000 feet, and in the west the mountains of the Jebel Marra tower to the same height above the monotonous rolling plain. But the dominant feature is the White Nile which cleaves the country in two, and with its powerful tributary, the Blue Nile, pouring out of the Ethiopian highlands, influences all life for more than 1,500 miles from the border of Uganda to Wadi Halfa.

In its upper reaches within the boundaries of the Sudan, the Nile broadens into a huge swamp choked with thick mats of papyrus. This is the famous Sudd, which in Arabic means "barrier." Today, channels are kept open and steamers run regularly, but for centuries this papyrus curtain kept the secret of the source of the Nile from all who tried to approach from the north.

During the annual rains the river creeps up from the permanent swamps and inundates an area the size of England. When the water retreats again in the dry season, this land becomes meadows of almost pure grass, which is known as the "toich." The calm sea of green is broken only by an occasional island of palms or acacia

on higher ground and shifting channels and lakes edged with the plumes of papyrus and "vossia," a reed known to the Arabs as "um suf" — mother of wool.

Our first area of study was in the "toich." At the old trading post town of Malakal we boarded a very Victorian sort of houseboat with a screened verandah on the upper deck and were propelled upstream by a woodburning paddle-wheel steamer alongside. As we passed the main landing of Malakal a hippopotamus surfaced, looked around, and sank in a swirl of bubbles. This hippo and a handful of his relatives were the only mammals we saw until we landed some thirty miles up-river the following morning. The variety and number of birds were astonishing. Herons and egrets lined the edge of the river, stalking fish and frogs in the shallows. Around the grassy points, flocks of Whistling Teal dabbled and sprang into the air at our approach. Other waterfowl were plentiful, as were the harrier hawks endlessly patrolling the water meadows behind both banks. Brilliant carmine and green bee-eaters zigzagged across the channel and far overhead vultures and kites circled in a cloudless sky.

We were impressed most by the shorebirds. These migrants from the Arctic coasts of Europe winter in their thousands along the Nile. Clouds of Ruffs and Ringed Plovers continually rose and settled again as we went by.

The next morning we waded ashore through shallow lagoons to dry land. We were on a large island which is a reserve for Mrs. Grey's Water-buck, the Nile Lechwe. The area holds several thousand and they are apparently undisturbed by the Nilotic tribesmen who graze their cattle and burn off the long grass in the reserve. This water-loving antelope moves in large herds. The mature buck is a striking blackish-brown with a white saddle on the shoulder, and long lyre-shaped horns. From the top of a termite mound we could see several hundred. They were a remarkable sight feeding in the tall grass beyond a quiet pond full of pelicans, ibis and spoonbills.

By evening we were back in Malakal, and set off the following day for the Boma Hills 450 miles to the southeast close up on the border of Ethiopia. Most of this trip was through flat country. The flood plain of the Nile extends nearly the whole way so the open grasslands continued, varied by extensive areas of acacia bush. All along the road above the level of the flood waters were the villages of the tribes. Most were empty as at this season the people go with their herds for fresh grazing and only return when the rains begin. As elsewhere in Africa, it is the practice to set fire to the long dry grass to obtain fresh new growth for the cattle. Rarely were we out of sight of burned land and the effect was depressing. There were few animals.

Near Boma the road crosses a reserve where burning is somewhat controlled. Here we found White-eared Kob and Reedbuck and Oribi, but the herds were shy of the road and moved off quickly. The hilly region around Boma at times is filled with thousands of Zebra, Tiang (the

Elephants have destroyed much of the vegetation in the small and heavily populated Nimule Park. Grass is closely cropped and almost every tree broken off and browsed. But the Park still attracts tourists.

northern relative of the Topi) and Hartebeest. It was empty during our visit and we met with only a few giraffe, the odd Roan Antelope and sixteen Zebra. The road to the south was impassable, so that we couldn't search in that direction.

We returned to the Nile at Bor, across grass-lands filled with small gazelles, and moved down to the town of Mongalla. Around here, too, the land is burned and over-grazed, and the animals are far back in the bush. We did see three herds of elephants, some seventy in all, moving to water late in the afternoon. Several were standing at a distance in a pond up to their knees, pulling up aquatic plants. They beat the bundles of vegetation against their legs to free the mud and slowly stuffed their mouths. Two reserves have been established in the area of Mongalla and contain a variety of species, but not in any number. The district is a popular shooting ground and the game is shy and dispersed.

The Sudan has three National Parks; one of 2,470 square miles near where the Blue Nile crosses the border with Ethiopia; another of 7,700 square miles in the southwest and the third on the Uganda border. This last is the Nimule National Park, lying between the Nile and the mountains to the west. It is only a narrow strip of country, barely a hundred square miles in all, but here we

saw the least disturbed animals in the nation. Uganda Kob bucks were stationed on their territories, the grass worn down to a circle of bare earth. The dark heavy shapes of Buffalo, like some unfamiliar breed of cattle, grazed in the distance. It was a new landscape. Smooth granite ridges covered with closely cropped grass rose from the edge of a swift stretch of the river. What trees there are have been browsed for years by elephants and look like the survivors of some radical pruning demonstration. Too many animals occupy too small an area, but the Park is nevertheless an important tourist attraction as well as a valuable sanctuary for a wide array of species. The White Rhinoceros is a conspicuous resident of Nimule. This northern race of the white rhino, which previously had been associated with South Africa, was not discovered until 1900. It is a social creature that usually is seen in small bands, but we were fortunate to see eleven in view together. They were feeding in a grassy swale and moved downwind toward the rocky outcropping which hid us from their view. A mother and calf came so close that we had to remove the long lenses from our cameras.

The Park is best at dawn. In the cool of the early morning, with the mist rising from the Nile, the air is filled with the songs of birds. The elephants that come to the river at night are often seen in considerable numbers before they go deep into the Park for the day. Only four were still in view on the morning I was there but these permitted us to approach within twenty yards and to watch them casually feeding and rubbing their tusks on a fallen tree.

From Nimule we went east again to the Imatong Mountains, a range of volcanic peaks in the southernmost part of the country. In the high valleys is a large forest reserve which included a protected rain forest of mahoganies and tall gums and figs draped with vines and plants. Here, high in the trees, we saw the handsome black and white Colobus Monkeys following each other in single file from branch to branch, searching for food and stopping to peer down at us. This monkey is highly valued for its pelt which is used in tribal dancing costumes and also exported from parts of its range. The animal is protected in the Sudan, and as firearms are rigorously controlled, quite successfully. However, in Ethiopia it is hunted relentlessly and thousands of skins are sent to market every year.

We returned to the open plains to the north of these mountains and drove through country that once must have been filled with game. Only a few Oribi dashed away from the jeep. Like rab-

bits, this antelope can survive on degraded, burned-over land and compete with the native cattle that drive all other animals away. During the rains, much of this district is flooded and used by elephants, whose enormous footprints harden in the clay as the land dries and make driving hazardous.

Next we went to the west bank of the Nile. The river is crossed by ferry at Juba, the second town of the Sudan, and the head of navigation. The town is a strange mixture of mud huts, unimaginative institutional architecture and European houses. Most of the outlying streets, though, are lined with trees and gardens, a welcome contrast to the drier country we had left. From Juba we went north following the Nile along the edge of ground which is under water during the rains. On one side of the road were the grassy meadows stretching off to the bank of the river, and on the other thorn and acacia bush. This is a thickly populated part of the country and at every turn in the road we came to a village or herdsmen and their cattle. The major tribe of the area is the Dinka, a Nilotic people who have a cattle economy and by and large leave the wild animals alone. The cattle, of course, compete with the wildlife, but we saw less destruction of the habitat by fire and overgrazing in many parts of the country here on the west bank than on the east.

Our route swung more to the west as the flood plain widened and tributaries from the Congo divide joined the Nile or flowed out to become lost in the Sudd. We progressed perhaps 150 miles a day and sometimes much more. At places which promised interesting animals, we stayed over a day and looked for them. Usually it was the same. Too many cattle around or the game was reported too far off the road to reach.

When we were able to get a bit off the main road, if such a name can be given to the somewhat improved dirt track we followed, we saw evidence of a considerable number of animals, but nothing like the still large concentrations of East Africa. Elephants, in particular, seemed to range over most of the land we traversed. There were pockets of Tiang and Kob, and often family groups of Giraffe, the odd Waterbuck or Roan Antelope. In a sense we were rather frustrated by geography, for nowhere were we able to go far into really wild country to see what it held except on foot, and there was little time. Nor were we equipped to travel any distance without our vehicles.

As we continued northward, the character of the country changed. The drier land carried larger trees and the river banks grew higher. At the Bahr el Arab, which means, "River of the Arab," the change was abrupt. To the south were the Dinka and their cattle, and on the north bank was an Arab village with horses and a few camels. We were in the Province of Darfur.

Just a few miles beyond the village the land became arid and sandy, and the vegetation changed. Thorn and the acacias associated with dry country became the dominant trees. Ostriches appeared in the open spots. Except for a handful of gazelles, we seldom saw animals from here on to the end of the trip — a few Baboons, Duiker, Vervet Monkeys, one young Kudu cow in the foothills of the Jebel Marra was all.

It is perhaps because this is the land of the Arabic tribes, born hunters who run down their prey from horseback, that there is so little game. These nomadic herdsmen have grazed this land for centuries and their number is increasing. Water is scant nearly everywhere and while this district is not true desert, not many species find it suitable to their needs. Further to the north, where vegetation all but disappears in a world of sun-baked rock and sand, other animals such as the Addax, White Oryx and Barbary Sheep are reported to occur in small numbers.

The Province of Darfur is distinctly different from the country to the south. The rainfall is limited to heavy downpourings in the summer months, when it fills the dry river beds, or wadis, to overflowing. The water rushes down from the higher ground, seeping into the dry earth so rapidly that several rains are needed to fill the streams, and they then flow on into the rainless plains and lose themselves in the sands. During the remainder of the year, water is available only from wells or ponds which are large enough to persist through the dry months. Only in the high country of the Jebel Marra, which is a volcanic massif rising 10,000 feet above sea level, are there streams that flow all year.

We were unable to go into the desert districts or to visit the mountains of the Red Sea Province. Nor did we see the National Park at Dinder on

By native custom, the skins of White-eared Kob does are used as wedding presents, resulting in abnormally large populations of bucks. A doe is on the right.

In this acacia grove in southern Darfur, almost every blade of grass has been eaten by the migrant cattle and goat herds owned by the Baggara tribesmen.

the Ethiopian border in the central part of the country. While the airplane has solved the problem of covering distances that until after the war took months, local transport is little better than it was then except on the rough and difficult dirt roads, and our time was limited. Neither were we able to complete our trip in the southwest, where various species of forest animals exist in the rolling, tree-covered hills along the Congo border.

Without having actually seen these large sections of the country it is of course impossible to draw any definite conclusions about the state of wildlife as a whole. Nevertheless, our trip, which exceeded 4,300 miles, uncovered various factors influencing the future of the wildlife of the Sudan.

First, the variety of habitat provides a niche for a great many species, and with a few exceptions there is enough space available to insure against extermination if conservation is properly practiced. The same might be said of other parts of the world, to be sure, but the Sudan is a much larger country than most and pressures of expanding human population do not now appear as great. Much of the land, too, is unsuitable for the vast expansion of agriculture, that will-of-the-wisp which is pursued with such avidity in so much of the world. It is probably true to say that the Sudan has no shortage of food and may

well be the best-nourished country in Africa, so the compulsion to bring land under the plough is less pervading. There is room for National Parks and reserves of sufficient area to insure that none of the fascinating species disappear and where they can be conserved as a national asset for posterity.

Against this over-simplification of the situation, there are a number of factors which, for the present, present difficulties. Foremost is burning. Fire for centuries has been an integral part of the life of both hunting and pastoral tribes. The hunters use it to remove the grass, which often grows over ten feet tall, so that their quarry can be seen, or else attracted to the short new grass that springs up after a burn. The herders fire the thick, unpalatable growth for the same reason. Other and possibly more fires are caused by carelessness, which can only be described as apathy. Honey gatherers invariably set fire to the tinder-dry grass when they smoke out bee trees. The campfires of nomads and travellers are left to burn out or, as is usually the case, to turn into raging flames that sweep the countryside. The tribes that practice shifting agriculture also use fire as a tool to clear new pieces of land every few years for their crops, with the same disastrous results.

Fire is not always the enemy of wildlife. Even before man became the most numerous animal on the continent, fire was a natural occurrence and through the course of centuries most of the more arid areas were swept by devastating fires at one time or another. The difference is that now the same grasslands and bush country is burned year after year until the vitality of the soil is wasted and can only nourish coarse grasses and thorn that cannot support either the wild animals or cattle. Only the goat, an exotic species, is at home in such degraded land.

Poaching, which is taking a frightening toll of animals in other parts of Africa, is not a real problem in the Sudan. At any rate there is no black market for meat and the ivory trade is rigidly controlled. Offenders are severely punished when they are found, and the sentence is not just a few months of three meals a day in a comfortable jail as in some other territories.

Paradoxically, a present threat to the wildlife is the Game Law. Nowhere else in Africa today is it permissible to shoot so much under license. One can even kill lion and buffalo with no license at all. Just a tourist visa will do. For sheer quantity, too, the Sudan is the place to shoot. On a Class A license, at a cost of £60, a hunter is allowed to kill over a hundred animals, even if it has to be done in a week. A resident can get the same license for a tenth the price. Only in the case of a few species is the limit, in an area where they are rare, different from that in places where they are plentiful.

This situation is not as ominous as it sounds, for the Sudanese officials are very much aware of the shortcomings of a licensing policy based on an Ordinance of 1935, and all applicants are carefully screened. Possession of firearms is also carefully controlled, and every owner of a rifle or shotgun is known to the Game Department. A permit is also required to purchase ammunition, and abuses of the Game laws result not only in a fine or prison term, but in the loss of gun and automobile if they are used to hunt illegally.

The regulations are — as in our own country — difficult to enforce. The shyness of the animals along the road is indicative of shooting from cars, but it must be admitted that the same thing happens in the Adirondacks. Fortunately, the Sudanese in government realize the problems and the values of their wildlife. All that is required is a more thorough knowledge of the needs and habits of the large variety of species so that they can be efficiently conserved. With such data, game laws can be drawn to insure adequate protection and to afford all the benefits that a wonderful natural resource can bring to any country.

In Africa, crises follow crises in the headlines and we forget that the Sudan has been an independent country for more than five years and is successfully managing its political and economic affairs.

The relatively stable economy and the level of education of a large number of the leaders in government make it possible for the country to make a real contribution to conservation in the continent. What must be brought home to them is that countries throughout the world are not respected and loved for their gross national product but for their people and their natural wonders. Very few travel to Switzerland to see the banks and the watchmakers!

EXIT TIMBER WOLF, ENTER COYOTE

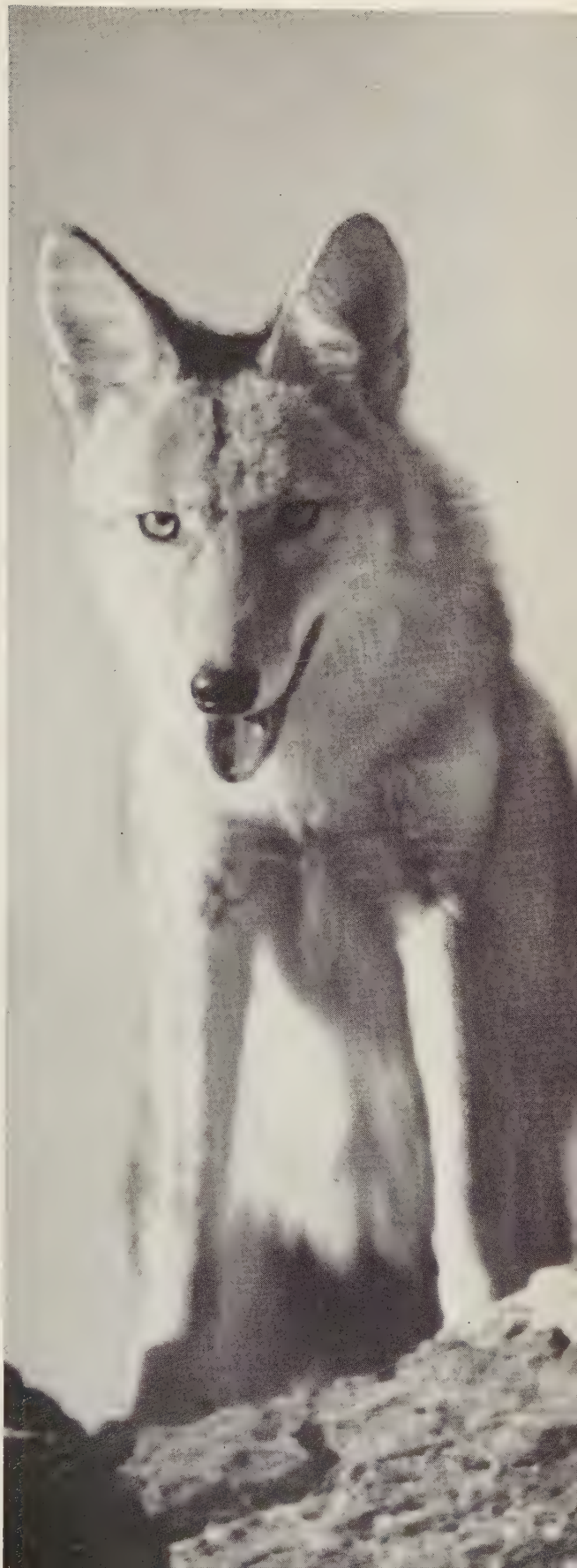
By DAVE MECH

SINCE THE WHITE MAN settled the United States, he has persecuted most large predators and destroyed their habitat. Extermination was the usual unfortunate result. Lynx, Fisher and Marten populations were greatly reduced, and Mountain Lions, Timber Wolves and Wolverines were eliminated from the Northeast. However, here man unwittingly *helped* one large carnivore — the Coyote. Fifty years ago there were none in the Northeast; now there are thousands.

Many people might question, "Do you mean the small Coyote so familiar in the West?"

No, these newly-established animals belong to one of the largest Coyote subspecies, *Canis latrans thamnos* (or Brush Wolf), occurring as far west as Kansas. The average adult female weighs 25 to 28 pounds; males average 32 to 35 but sometimes reach 60 pounds. The color also varies. While most Coyotes are generally a mixture of black, gray and brown, individuals might be almost black or very light tan.

Trappers sometimes catch Coyote-like animals



The Coyote was long thought of as typical of the West; today it is equally representative of broad sections of the Northeast, where it moved in after extermination of Timber Wolves.

Photo by E. P. Haddon, U.S. Fish & Wildlife Service

Top — A Coyote brings a Jackrabbit lunch to its pup at the den. (E. R. Kalmbach photo). Right — Doglike tracks of the Coyote now appear on old woods roads and paths in the Northeast wild areas. (Mech photo)

with almost pure red and white fur, but these are undoubtedly hybrids with dogs such as collie, German shepherd and airedale. This pollution of the Coyote strain usually occurs on the outskirts of the animal's range, where dogs run freely. Some of the hybrids sport such dog-like characteristics as dew claws on the hind legs, floppy ears and curly facial fur. In addition, the "coy-dog" is usually larger than the Coyote, sometimes reaching 70 pounds. On the whole, these are much less common than pure Coyotes.

How did the first Coyotes get here? No one really knows, but there are a few theories. One is that trappers brought them to create a population for which they could get bounties. Another is that they were bought as pups, for pets, and when they grew too large, were released. Probably both theories account for *some* Coyote records in the East, but the present established population is probably a result of natural movement.

As timber resources and Timber Wolf numbers diminished in Michigan, Wisconsin and Minnesota, the few Coyotes there gradually increased. The species probably became firmly established in Michigan about the turn of the century. Ontario reported its first Coyote in 1919, and soon they were found throughout the province. Then they might have crossed the ice of the St. Lawrence River and entered the Adirondack mountains of New York. Indeed, one was recorded there in 1925. In the mid-thirties, a second was killed and there were reports of others south of Saratoga. About 1942 populations became established in the Adirondacks and in that year the first Coyote in Vermont was taken.

New York populations occurred in seven areas, mostly on the St. Lawrence side of the Adirondacks. In ten years, the state's Coyote range expanded from about 700 square miles to 16,000. By 1955 the animal occupied not only the entire Adirondacks but the whole northern third of the state. There are now records of Coyotes in southern New York State, the latest from a few miles northeast of Norwich.

Meanwhile the species continued to spread from New York. In Vermont the Coyote has been recorded from nearly all of the 14 counties; about 20 are killed there annually. New Hampshire reported a single Coyote in 1944, and a den of Coyote-like pups and an adult in early 1960. The first Coyote showed up in Massachusetts in 1957.

In 1958 three other specimens were trapped in the central part of the state, and at least two others still roam the area.

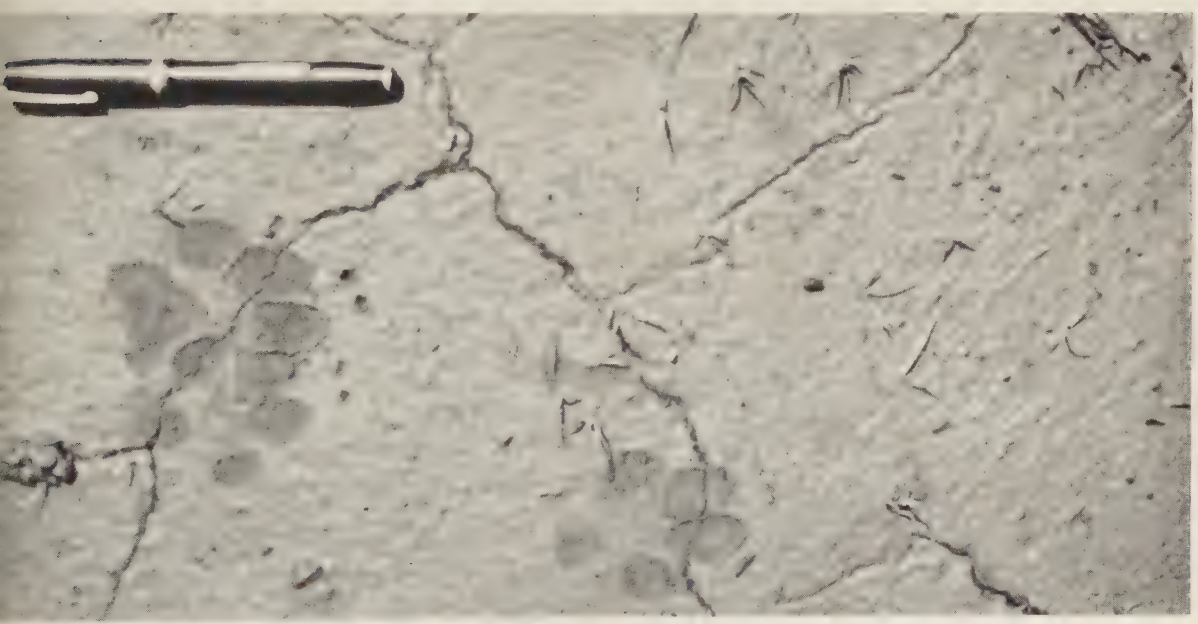
Between 1945 and 1953, New Jersey had four Coyote records; recently another animal was taken. Pennsylvania now has a small Coyote population in the Poconos, and last summer a den of seven pups was found in Cameron County.

Now that the Coyote has become established in the Northeast, how will it affect other wildlife? Some people's first thought is that since the creature is a predator, it *must* be doing damage. However, is this necessarily true? A scientific look at the Coyote in New York, for instance, reveals many interesting facts that casual observation will not. While game biologists do not deny that Coyotes kill deer, they ask us to take a broader look at Coyote-deer relations. They point out that despite the increasing numbers and range of the Coyote from 1942 to 1954, deer hunting improved; reported buck-kill almost doubled. Similarly in Michigan, where for years bounties were paid on almost 3,000 Coyotes annually, the deer population continued to increase. Although Coyotes sometimes kill deer, they do not control the population.

Whenever Coyotes prey on deer in the Northeast, they probably are *benefiting* the deer herd, anyway. Herds in most northeastern states are exceeding their food supply and ruining future browse. Thus every deer killed helps alleviate this sad situation. (See "Our White-tailed Deer Problem" by Milt Stenlund in *Animal Kingdom,* July-August, 1959).

Coyotes seem to depend much more on the prolific rabbit and hare for their food supply than on deer. It was during the upswing of the Snowshoe Hare population in New York that the Coyote increased; and the carnivore seems to be more common in areas of high hare concentrations. Food-habits studies on thousands of western Coyotes prove the species feeds heavily on rabbits and hares. Studies in New York show that squirrels, mice, carrion, berries, and beechnuts also form a large part of the Coyote's diet.

I shall never forget the looks of several Adirondack deer hunters one fall when I examined the digestive tract of a "big bad wolf" one of them had killed. They fully expected the tract to be crammed with deer hair. Were they startled upon seeing that it was packed solidly with beechnuts – and 14 inches of clothesline! Before, the hunters thought Coyotes ate only deer; now they believe the animals eat only beechnuts – plus an occasional piece of clothesline, of course.



Because its diet includes some game species, the Coyote has attained a bad reputation in some circles. Unsuccessful deer hunters find it consol-

Here is where you are likely to find the Coyote — in remote and brushy, forested mountains and hills in the Northeastern U. S.
Photo by the author

ing to blame the predator. Snowshoe Hare hunters condemn it for taking what is "theirs." Many well-meaning but misinformed citizens believe all predators should be exterminated. Therefore New York has been pressured into Coyote control programs, and many counties offer a $25.00 bounty.

While more than a hundred Coyotes are taken annually in New York alone, the control programs have shown only one thing — the Coyote is here to stay! It is a wise quarry. Many a trapper has found his trap dug out and the bait stolen because the trap was not completely free of human scent. Not only is the Coyote smarter than the proverbial fox, but it also travels like a salesman. Moving into an area, it remains a few days, then moves on. Ten days might pass before it returns. One Coyote which was live-trapped, ear-tagged and released by New York biologists was recaptured 22 miles from its first capture point. Thus a trapper may see Coyote tracks and set a trap or two, but chances are the animal is several miles away. A third reason why Coyotes are difficult to control is that much of their range is relatively inaccessible. They prefer remote, brushy or lightly-forested mountains and hills.

Coyotes trapped are rapidly replaced since each breeding pair bears an annual average of six young. A pair often remains together for years, breeding each February. The young are born 63 days later in an abandoned woodchuck hole or fox den which the female enlarges, or in a hollow log, stump or rock cave. They open their eyes after about two weeks and appear at the den entrance a week later.

Both parents feed their offspring, often carrying prey for miles. About early July the pups venture forth on hunting expeditions with their parents. By mid-fall when they are almost full grown, they strike out on their own. Tagging studies show that one year later the young Coyotes have dispersed to an average of 25 miles from their den. Some have been found 250 miles away. It is easy to see how the Coyote range increased so rapidly. It is also easy to see that this handsome newcomer will remain here in the Northeast for many years.

Thus it took nature only about 60 years to fill the niche left by the extermination of the Timber Wolf. Those of us who mourn the loss of the Timber Wolf welcome the establishment of the Coyote. Now again a wilderness camper can sit by his campfire in the Northeast and listen to the yips and howls of a canine chorus — a chorus advertising nature's contempt for man's interference and boasting of her new triumph!

News from the Conservation Foundation

Arusha African Conference

In 1959 Dr. F. Fraser Darling made a protracted tour through fourteen territories of Africa, gauging opinion on the idea of a conference at a high level for discussion of the value of African wildlife for the peoples of Africa. Wildlife is not only one of the principal assets for tourism, but, as Dr. Darling and others have pointed out, the animals can be carefully harvested to augment the food supply. Furthermore, wild animals themselves have great value in maintaining the rather tender vegetative cover of much of tropical Africa.

The proposal for a conference was taken up by the International Union for the Conservation of Nature, and at the IUCN conference in Warsaw last year a special project for Africa was launched. A tour by Mr. Watterson, Secretary-general of the IUCN, through the independent African territories, to be followed by a conference in Arusha, Tanganyika, in September of this year, was decided upon. The New York Zoological Society contributed to the IUCN for Mr. Watterson's tour, and Dr. Darling will attend the Arusha meeting as the representative of The Conservation Foundation. He will present a background paper on habitat as part of the conference's technical session, which is scheduled to deal with the present role of natural resources, their research, conservation and development, and the place of nature and conservation in land-use planning. A general session will emphasize wild natural resources as economic and cultural assets, and will discuss local and world attitudes and programs for conservation development and education.

Population Symposium

The Foundation has long held the belief that the world-wide significance of steadily increasing population pressures on all phases of man's environment and future well-being is too little understood. Acting in this belief, the Foundation is now gathering statements on the importance of the problem, to be published as a book by Doubleday & Company. The contributors, all outstanding leaders of thought and action in various fields of human endeavor, will write concise statements of conviction on the implications of growing population pressures in areas of their special interest.

Among the eminent writers who have accepted to date are: Marston Bates, Henrique Beltran, Eugene R. Black, Lord Boyd-Orr, Grenville Clark, Henry Steele Commager, F. Fraser Darling, Rev. Robert I. Gannon, S.J., Robert M. Hutchins, Aldous Huxley, Sir Julian S. Huxley, Joseph Wood Krutch, Walter C. Lowdermilk, André Maurois, Frederick H. Osborn, Bishop James A. Pike, S. Radhakrishnan, Earle L. Rauber, Paul B. Sears, Irene B. Taeuber, Arnold J. Toynbee and Sir Solly Zuckerman.

Briefly Noted

Dr. Osborn has accepted an invitation to write an article on "The Problem of People: Pressures of Population on Our Whole Way of Life, As Envisaged 25 Years Hence" for the 175th Anniversary celebration of the Pittsburgh *Post-Gazette* . . . In "Plunder or Plenty?" the lead article in the *Saturday Review* for April 15, Samuel H. Ordway, Jr., outlined attitudes on conservation over the last century and a half, as exhibited in books and essays, and pointed out the need for practical application of general conservation theories . . . The June edition of *Vital Issues,* published by the Center for Information on America, will be devoted to an article on "Conservation and Pest Control: How Best Can Both Operate Together?" contributed by Dr. Darling for The Conservation Foundation . . . Wallace Bowman represented the Foundation at the Second National Congress on Environmental Health at Ann Arbor, Michigan, June 6-8. Mr. Bowman has also accepted an invitation to attend a Cornell conference on the problems of suburban growth, in Ithaca, N. Y., June 15-16.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Mr. Conway Becomes Director of the Zoological Park

WILLIAM G. CONWAY

The appointment of William G. Conway as Director of the New York Zoological Park was announced on June 8 by President Fairfield Osborn.

Mr. Conway came to the Bronx Zoo on November 15, 1956, as Associate Curator of Birds and was made Curator of Birds at the beginning of 1958. Since June 2, 1960, he has been Associate Director of the Zoo.

Zoo management has been a life-long interest of Mr. Conway's since, at the age of 18, he began working at the St. Louis Zoo to pay for his education at Washington University. Subsequently he was for six years Curator of Birds at the St. Louis Zoo. Specializing in Zoo management, he has studied operations of every major Zoo in the United States and many in Europe, has written many technical articles on Zoo operations, and has been called in as advisor to Zoos in Colorado Springs, Boston, Evansville, Detroit, Washington, New Orleans and Kingston, Jamaica.

Since being at the Bronx Zoo, Mr. Conway has taken a leading part in devising the current expansion program of the Zoo and in planning novel buildings and exhibits.

Dr. John Tee-Van, General Director of the Zoological Park and the New York Aquarium, will continue in that position.

Judy Brown's "Noah's Ark" on Exhibit in the Zoo

Over the years the Zoological Society has had many animals-in-art exhibits in the Heads & Horns Museum in the Zoological Park – animals in wood and stone and ceramics, on paper and canvas, created by carving and chiseling and molding and painting. But never created by the welder's blowtorch until now, when we have opened a summer exhibit of work by Judy Brown.

The animal figures that ride a large wooden ark – there are 25 pairs of them, ranging in size from elephants to mice – were literally created by a blowtorch and melting metal rods, a technique for which Miss Brown is noted.

The Zoo's exhibition was featured (in color) on the cover, and in an article, in the May 14 issue of *This Week* magazine.

IN BRIEF

Award for Monograph. The monograph called "The Bighorn Sheep in the United States, Its Past, Present, and Future," by Dr. Helmut K. Beuchner, has been given an award for "excellence in reporting research in the field of terrestrial wildlife management" by The Wildlife Society. The work on which the monograph was based was done by Dr. Buechner for the Zoological Society and The Conservation Foundation, and it was published in May of last year. Copies are available at the Publications Office, the Zoological Park, New York 60, N. Y., at $1.50.

Wheatear at Sea. A European Wheatear flew exhausted onto the North German Lloyd liner *Bremen* on the night of April 19, while the vessel

was in the English Channel. Such havens for stray birds have often produced interesting specimens for the Zoo's collection in the past – and the Wheatear is the latest, for it was rescued by Erich Harken, one of the stewards, and cared for until the *Bremen* reached New York. We now have it in the collection – the first European Wheatear we have exhibited in 27 years.

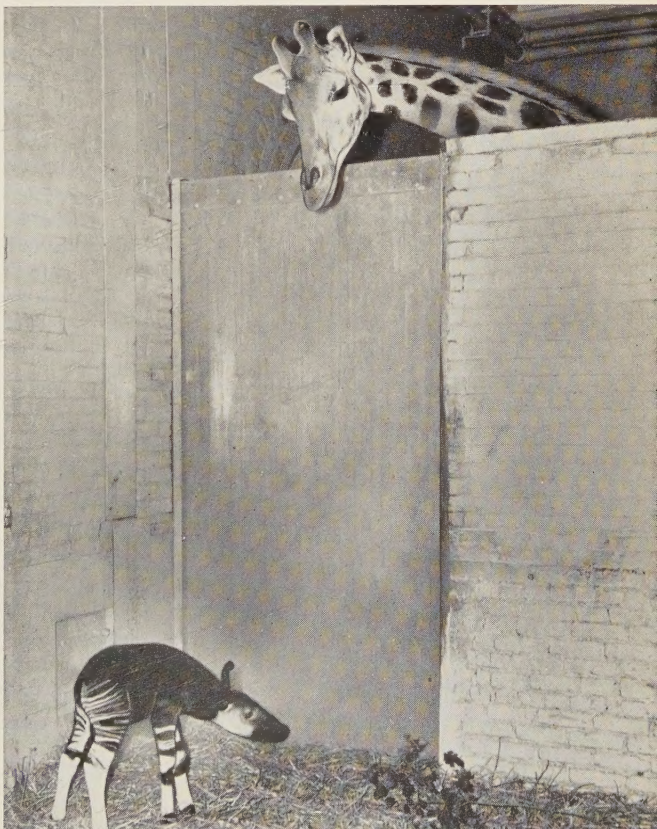
The Walrus Complex. The name does *not* refer to a psychological state – merely to the series of three pools being built at the Aquarium at Coney Island for Olaf and Ookie, our Atlantic and Pacific Walruses. Work has continued all spring and the pools are advancing rapidly. Two large ones will be for exhibition and a smaller pool in the "complex" will be used for isolation. Seals and other aquatic mammals may be kept in the pools if necessary. Work is also moving ahead rapidly on the filtration and water-treatment system for the large Oceanic Tank. Another new exhibit is botanical in nature – a planted area showing the plants normally found on beaches and sand dunes along the North Atlantic coast.

Python Eggs Again. A female Indian Rock Python in the Reptile House collection laid 21 eggs in a "nest box" in the corner of her compartment on April 5 and for a few days we had hope that they would hatch. Subsequent examination showed that most of them spoiled during the first week, however, because of highly fluctuating temperatures on the floor of the compartment. Curator Dowling made precise temperature measurements in the reptile's coils, on the floor, among the eggs, and in the surrounding air and found that the python maintained a temperature 10 degrees above the minimum around her. She apparently is able to do this by means of periodic muscular contractions. Her temperature stayed at 90 degrees.

For Children. The Children's Zoo reopened for the season – its twenty-first – on Saturday, May 20, and the Farm-in-the-Zoo reopened on Sunday, June 4. A special feature of the Farm's opening was the presence of Miss Bonnie Sue Houghtaling of Swan, Iowa, the "1961 American Dairy Princess."

John Curran of "Newsday" made this picture of a Baikal Seal at the Aquarium. It was shown in the International Zoo Photo Contest, Chicago.
Photo courtesy of "Newsday"

"What's Buzzin', Cousin?" by Photographer Jim Nightingale of "Newsday" was made at the Bronx Zoo, won an Honorable Mention.
Photo courtesy of "Newsday"



PUBLICATIONS OF INTEREST

WHY FISH BITE AND WHY THEY DON'T. By James R. Westman. 211 pp., 40 drawings. Prentice-Hall, Inc., Englewood Cliffs, N. J. 1961. $3.95.

Angling is much more of an art than a science, but Dr. Westman, who is an experienced fisheries biologist as well as an expert angler, is convinced that a more scientific approach to the sport would provide fishermen with greater satisfaction – and more fish. Dr. Westman makes his point with humor and insight, and he backs it up with concrete advice on when and how to fish. His tips alone should be worth the price. – J. W. Atz.

LIVING FISHES OF THE WORLD. By Earl S. Herald. 304 pp., 145 color and 149 black-and-white photographs. Doubleday & Co., Inc., Garden City, N. Y. 1961. $12.50.

This handsome volume lives up to its ambitious title; it does present a descriptive account of all the different groups of fishes alive today. It is the most complete survey of the fishes ever written in non-technical English and is beautifully illustrated by the finest collection of fish photographs ever assembled. We are pleased to note that 17 of these are from the Zoological Society's files, mostly taken by Staff Photographer Sam Dunton at the New York Aquarium. – J. W. Atz.

LISTEN, THE RED-EYED VIREO. By Milton White. Illustrated by F. B. Modell. 96 pp., many drawings. Doubleday & Co., New York, 1961. $2.75.

Every bird-watcher will approach this seemingly irreverent little book with apprehension. We don't like to have our hobbies made fun of, after all. But in a very few pages it appears that the story of a young college professor being introduced to bird-watching is not irreverent; in fact, a great revelation comes to him. It is a funny book, a true one, a real delight. And the jocose-affectionate illustrations by a *New Yorker* cartoonist are just right. – W. B.

SERENGETI SHALL NOT DIE. By Bernhard & Michael Grzimek. Introduction by Alan Moorehead. Translated by E. L. & D. Rewald. Many photographs in color and black-and-white. 344 pp. Dutton & Co., New York, 1961. $6.95.

A fighting, informative, persuasive book about the great Serengeti Plains in Africa, by the Director of the Frankfurt Zoo and his son, to whom conservationists owe eternal gratitude. Michael Grzimek lost his life in an airplane accident over the plains; Dr. Grzimek is carrying on the fight with his writing and magnificent motion pictures. A book that every conservationist with an interest in Africa should own.

GALAPAGOS. The Noah's Ark of the Pacific. By Irenaus Eibl-Eibesfeldt. Translated by Alan Houghton Brodrick. Many photographs, end papers in color photos. 192 pp. Doubleday & Co., New York, 1961. $3.95.

A readable account of present-day conditions on the islands that Darwin made famous, by the man commissioned to select a site for a biological laboratory there during the Darwin celebration.

New Members of the New York Zoological Society

(Between March 1 and April 30, 1961)

Associate Founder

Miss Irene Hayes

Founder

Robert G. Stone

Life

Mrs. Imrie de Vegh
Mrs. Charles F. Slotter

Supporting

Mrs. Winthrop W. Aldrich
Robert M. Ferguson
Mrs. Cordelia S. May
Fortune Peter Ryan

Fellow

Roger Tory Peterson

Contributing

Mrs. Ruth P. Anspach
Elting Arnold
Clifford S. Bailey
William F. Bartlett
Mrs. Dennistoun M. Bell
Miss Avis Berglund
Robert A. Bernhard
Richard Bersohn
Abraham Blond
Mrs. Clement S. Brainin
Mrs. Gilbert G. Browne
George L. Burr
William G. Burt
R. H. Byrne, Jr.
Arthur E. Cameron
Mrs. Robert L. Coshland
Arthur M. Crocker
Miss Diantha Deery
George F. Dembow
Frank H. Detweiler
Jacques de Wolfe
Miss Alene Diamond
Anton Diebold
Dr. William F. Dorsey
James Gordon Douglas
Mrs. Frederic W. Ecker
William H. English, Jr.
William K. Erhart
Jonathan Fink
Mrs. Thais Joan Fischel
Mrs. Robert M. Gardiner
Mrs. William T. Golden
Mrs. S. Delvalle Goldsmith
DeCourcy L. Hard
Mrs. Alfred Hecht
Mrs. Charles W. Holton
Mrs. Edward W. Howell
Mrs. Henry M. Hubshman, Jr.
H. G. Jacobs
William B. Kerr
Robert P. Koenig
Miss Brenda Kuhn
Mrs. Leatrice Lawrence
Mrs. Sadye Levi
Alden R. Loosli
Mrs. John J. Messmann
George P. Milmine
Alex Mitchell
Frederick Morgan
Constantine Nickou
T. F. Oakes
Mrs. Frederick Packard
Richard C. Paine
Meyer Pasamanick
Dominick J. Pirone
Mrs. Charles L. Pitman
Mrs. Roslyn A. Roller
Mrs. Michael Roth
Arthur Samuels
Henry Schnakenberg
John C. Schoenherr
Mrs. Theodore Schulze
Dr. Cecily C. Selby
Henry Templeton Smith
Fred H. Stern
Mrs. Fred H. Stern
Stephen E. Straus
George G. Tyler
Miss Alice W. Wardwell
Alexander Weber
Charles D. Webster
David Weld
Will C. Weng

George Willett
Dr. Julius Wolf
Harrison Wright

Annual

Mrs. Daniel Adler
Mrs. Paul G. Agnew
Mrs. Virginia G. Allison
Arthur G. Altschul
Miss Norma Angel
Henry George Atkinson
Mrs. Louis P. Bayard
Miss N. P. Bence
Mrs. Nathaniel Benchley
Mrs. Richard S. Benua
Derick W. Betts
Joseph Berey
Edwin F. Blair
Richard H. Blanding
Mrs. Walter A. Bobrow
Mrs. F. H. Bontecou, Jr.
Jack W. Brand
Dr. Robert G. Brayton
O. Carlyle Brock
Miss Georgena E. Brooks
Miss Barbara Anne Bryant
Mrs. Harris H. Bucklin, Jr.
F. A. Bush
Dr. William G. Cahan
Victor M. Calderon
Mrs. Charles W. Caldwell
Thomas A. Callahan
Mrs. William C. Carter
Peter P. Casola
Dr. George H. Childs
Mrs. George H. Childs
Steve Chmil
Mrs. Abbott Clark
George A. Cluett, Jr.
W. B. Connor
Joseph John Cox
Gerald S. Craig
Miss Halle December
Mrs. Forbes Delany
Jerome V. Detmer
Ivan Dmitri
Raymond A. Dobosiewicz
Mrs. W. F. Dominick
Lester L. Doniger
Miss Ruth K. Dunn
Mrs. Albert Edelman
Mrs. Lois H. Engel
Princess Diane R. Eristavi
Mrs. Florence R. Ferguson
Dr. Floris Ferwerda
Mrs. Joanne L. B. Finney
Dr. J. M. Ford
Mrs. William Ward Foshay
Mrs. Adelaide S. Frank
Thomas W. Frank
Mrs. Elizabeth Frazier
Frederic B. Freyer
Mrs. William I. Frothingham
Mrs. Reynolds Girdler
Mrs. Dulaney Glen
Miss Josephine Goldberg
Irving S. Gordon
Hugh H. Harman
Elbert Harris
Mrs. Victor Harris
Harry L. Hartl
Dr. J. Paul Harvey, Jr.
Mrs. Peter Herrick
Mrs. Margaret Carson Holt
Peter B. Hope
Jerome Horowitz
Alfred O. Hoyt
F. A. Huestis
Mrs. James B. Hunter
Mrs. Waldo Hutchins, III
Michael Imberman
Mrs. Harald Ingholt
Dr. Jack Jacobs
Aaron Jarvis
C. Paul Jennewein
Mrs. Lawrence I. Kaplan
Herman Katz
Mrs. Edna M. Kaula
Mrs. Catherine E. Kelts
E. I. Kilbourne
Miss Janice L. King
Rollo A. Kline
Miss Helen Klintrup
William B. Kondratuk
Mrs. Arthur J. Korte
Joseph J. Kuchar
Mrs. Rudolf Kuck
Miss Lee Ann Larsen
Leo Lenz
Mrs. Farnsworth Loomis
Mrs. John D. Mack
Arthur C. Manning
Frank A. Mastropaolo
John McChesney
Mrs. Walter R. Moore
Mrs. Richard G. Mozer
Robert J. Mozer
Dr. Erwin T. Muller
E. K. Nadell
Mrs. T. F. Oakes
Paul O'Brien
Mrs. George T. Oliver
Carmine J. Palermo
James Parton
Dr. Howard Patterson
Mrs. Dorothy Perrin
Harvey Picker
Mrs. C. L. Pitassy
Mrs. Penelope S. Potter
William R. Potts
David C. Quinn
Mrs. Clifton Read
John Redmond
Gerald R. Rising
William M. Robinson, Jr.
Mrs. A. J. Santry, Jr.
Fred W. Schmitz
Mrs. Henry L. Schwartz
Mrs. S. A. Shenker
Edward Shorin
Mrs. Charles N. Shepard
Norman Silverman
Mrs. James Kellum Smith
Mrs. Joan Audrey Smith
Philip W. Smith, Jr.
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